

a semiconductor laser region, and

a semiconductor layer;

the semiconductor laser region and the semiconductor layer being integrally formed as one unit on the semiconductor substrate in a lateral direction to emit light from the side of the semiconductor layer;

wherein the semiconductor layer has a function of changing the spot-size in a layer direction of light emitting from a semiconductor laser by changing a refractive index of the semiconductor layer in the layer direction.

17. The semiconductor laser device with a spot-size converter according to claim 16, wherein a semiconductor layer is a graded index to gradually change a refractive index thereof in a layer direction.

18. The semiconductor laser device with a spot-size converter according to claim 17, wherein at a time of passing light emitting from the semiconductor laser region through the semiconductor layer, the spot-size of light is periodically changed or shows a behavior of a portion of the periodical changing.

19. The semiconductor laser device with a spot-size converter according to claim 16, wherein the most highest region of refractive index of the semiconductor layer is one conformed with an approximate central portion of a distribution of light emitting from the semiconductor laser region.

20. The semiconductor laser device with a spot-size converter according to claim 17, wherein the most highest region of refractive index of the semiconductor layer is one conformed with an approximate central portion of a distribution of light emitting from the semiconductor laser region.

21. The semiconductor laser device with a spot-size converter according to claim 18, wherein the most highest region of refractive index of the semiconductor layer is one conformed with an approximate central portion of a distribution of light emitting from the semiconductor laser region.

D1 22. The semiconductor laser device with a spot-size converter according to claim 16, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a second semiconductor layer having a substantially constant refractive index is formed.

23. The semiconductor laser device with a spot-size converter according to claim 17, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a second semiconductor layer having a substantially constant refractive index is formed.

24. The semiconductor laser device with a spot-size converter according to claim 18, wherein on the boundary between the semiconductor

layer and the semiconductor laser region, a second semiconductor layer having a substantially constant refractive index is formed.

25. The semiconductor laser device with a spot-size converter according to claim 19, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a second semiconductor layer having a substantially constant refractive index is formed.

26. The semiconductor laser device with a spot-size converter according to claim 16, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a dielectric layer is formed.

27. The semiconductor laser device with a spot-size converter according to claim 17, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a dielectric layer is formed.

28. The semiconductor laser device with a spot-size converter according to claim 18, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a dielectric layer is formed.

29. The semiconductor laser device with a spot-size converter according to claim 19, wherein on the boundary between the semiconductor layer and the semiconductor laser region, a dielectric layer is formed.

30. A semiconductor laser device with a spot-size converter comprising:

- a semiconductor substrate;
- a semiconductor laser region, and
- a light waveguide region;

the semiconductor laser region and the light waveguide region being integrally formed as one unit on the semiconductor substrate to emit light from the light waveguide region;

wherein at a joint region between the semiconductor laser region and the light waveguide region, a dielectric layer is buried therein.

31. A semiconductor laser device with a spot-size converter comprising:

- a semiconductor substrate;
- a semiconductor laser region;
- a light waveguide region;

the semiconductor laser region and the light waveguide region being integrally formed as one unit on the semiconductor substrate in a lateral direction to emit light from the light waveguide region;

wherein at a joint region between the semiconductor laser region and the light waveguide region, a semiconductor layer is buried therein;

32. The semiconductor laser device with a spot-size converter according to claim 31, wherein the semiconductor layer has a refractive index which is substantially constant.

33. The semiconductor laser device with a spot-size converter according to claim 31, wherein the semiconductor layer has a refractive index which is changed continuously in a layer direction or varied step wisely.

34. The semiconductor laser device with a spot-size converter according to claim 31, wherein the most highest region of refractive index of the semiconductor layer is one conformed with an approximate central portion of a distribution of light emitting from the semiconductor laser region, and with an approximate central portion of an intrinsic mode of the light waveguide region.

35. The semiconductor laser device with a spot-size converter according to claim 31, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, another semiconductor layer having a refractive index which is substantially constant is formed.

36. The semiconductor laser device with a spot-size converter according to claim 32, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the

semiconductor layer and the light waveguide region, another semiconductor layer having a refractive index which is substantially constant is formed.

37. The semiconductor laser device with a spot-size converter according to claim 33, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, another semiconductor layer having a refractive index which is substantially constant is formed.

38. The semiconductor laser device with a spot-size converter according to claim 34, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, another semiconductor layer having a refractive index which is substantially constant is formed.

39. The semiconductor laser device with a spot-size converter according to claim 31, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, a dielectric layer is formed.

40. The semiconductor laser device with a spot-size converter according to claim 32, wherein on the boundary between the semiconductor

layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, a dielectric layer is formed.

41. The semiconductor laser device with a spot-size converter according to claim 33, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, a dielectric layer is formed.

42. The semiconductor laser device with a spot-size converter according to claim 34, wherein on the boundary between the semiconductor layer and the semiconductor laser region and/or the boundary between the semiconductor layer and the light waveguide region, a dielectric layer is formed.